

Winter **Weddell Gyre** Study Microwave Radar Observations
coupled With Air-Sea-Ice Surface Flux Measurements

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The Antarctic Zone, poleward of the antarctic polar oceanic front, is the site of vigorous ocean-ice-atmosphere exchanges. The latter are responsible for generating a cold water mass common to the deep basins of the global ocean and for ventilation of the Southern Ocean. Seasonal formation of an extensive sea ice cover, especially in the **Weddell Sea**, is connected to water mass modification through its influence upon the salt and freshwater budgets and through the initiation of deep-reaching convective processes. Combinations of shipborne and satellite microwave data have shown that the occurrence of overturning and the exchange and mixing of cold, low salinity surface waters with warm saltier deep water is closely linked to disturbances in the winter thermohaline stratification. The weak stasis existing between the mixed layer and deep water may be upset by the injection of salt into the surface water through new ice formation in predominantly divergent areas of sea ice or polynyas. Such sea ice features represent holes in the insulating sea ice blanket and can modulate the horizontal and vertical thermohaline and freshwater fluxes of this region. These features are therefore of key importance to an understanding of the ventilation capacity of the Southern Ocean and the wider impact of the Antarctic zone upon the deep ocean and the global climate.

Weddell Sea experiments taking place in 1992 as part of the Antarctic Zone (AnZone) included a coordinated series of shipborne and drifting ice camp work, providing an unprecedented opportunity to obtain surface flux measurements in conjunction with Southern Ocean ERS-1 satellite microwave data. In the Western **Weddell Sea** a joint US-Soviet icecamp (Ice Station **Weddell**) was established in February 1992 and drifted northwards (until June 1992) sampling the ocean ice and atmosphere along its path. Another complementary Winter **Weddell Gyre Study** (WWGS '92), conducted by German, Canadian and US investigators on-board *Polarstern*, simultaneously deployed drifting buoys and acquired surface measurements in the Eastern **Weddell Sea**. Further investigations were performed from vessels of opportunity servicing the drifting ice station, such as the new NSF ice-breaker, the Nathaniel B. Palmer,

Remote sensing data acquisition by the ERS-1 SAR throughout the experiment (between January and September) was facilitated by the German Antarctic Receiving Station. Simultaneously, SSM/I data and AVHRR data were collected for comparison with SAR imagery. During satellite data acquisition a program of shipborne active and passive microwave observations, coupled with in-situ measurements allowed investigation of the microwave signature of various key Antarctic sea ice forms. To determine the feedbacks between sea ice and surface fluxes, satellite-derived products such as sea ice maps are being integrated with surface (wind and temperature) data. The deployment of Argos drifters and passive radar reflectors enable validation of satellite SAR-derived ice motion vectors in pre-designated locations. This analysis will be integrated with the shipboard microwave observations and Ice Station **Weddell** (ISW) oceanographic and surface measurements. Regional surface-flux measurements in regions of SAR-characterised ice types will be extended to mesoscale flux estimates by mapping the regional distribution of sea ice forms. Frequent coverage SAR data enable Lagrangian ice motion information and the mesoscale framework of ice types to be derived, with which Ice Camp and shipborne (spatially and temporally restricted samples) oceanographic and ice data (Eulerian) can be combined. Together these data allow detailed studies demonstrating the impact of particular ice conditions in both preconditioning and modifying the mixed layer beneath sea ice.

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